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THE INSTITUTE OF
CHARTERED ACCOUNTANTS
OF SRI LANKA

SUGGESTED SOLUTIONS

02104 – Business Mathematics and Statistics

Certificate in Accounting and Business I Examination
September 2013

THE INSTITUTE OF CHARTERED ACCOUNTANTS OF SRI LANKA

PAPER 'A'

ANSWERS FOR MULTIPLE CHOICE QUESTIONS

1.

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20.

Answer No. 01

(a)

OPTION 1						
Year	0	1	2	3	4	5
Capital Cost	-20.5					
Maintenance Fee		-1.8	-1.8	-1.8	-1.8	-1.8
Purchase of furniture	-4.5					
Const of colour washing the apartment				-2.5		
Sale back Income						15
Income from furniture auction						2.5
	-25	-1.8	-1.8	-4.3	-1.8	15.7
DCF @ 15%	1	0.87	0.756	0.658	0.572	0.497
PV	-25	-1.566	-1.3608	-2.8294	-1.0296	7.8029
NPV						-23.9829
OPTION 2						
Year	0	1	2	3	4	5
Lease Rental /Legal fees	-1.2	-4.8	-4.8	-4.8	-4.8	-4.8
DCF @ 15%	1	0.87	0.756	0.658	0.572	0.497
PV	-1.2	-4.176	-3.6288	-3.1584	-2.7456	-2.3856
NPV						-17.2944

(7 marks)

(b) As the NPV of option 2 is lower, leasing is more economical. **(2 marks)**

(c) Revised purchased price of the house = $20.5 - (23.98 - 17.29) = \text{Rs. } 13.81 \text{ million}$

(3 marks)

(Total 12 marks)

Answer No. 02

(a) Fixed cost = $\frac{12 \times 1,000,000 \times 20\%}{80\%}$

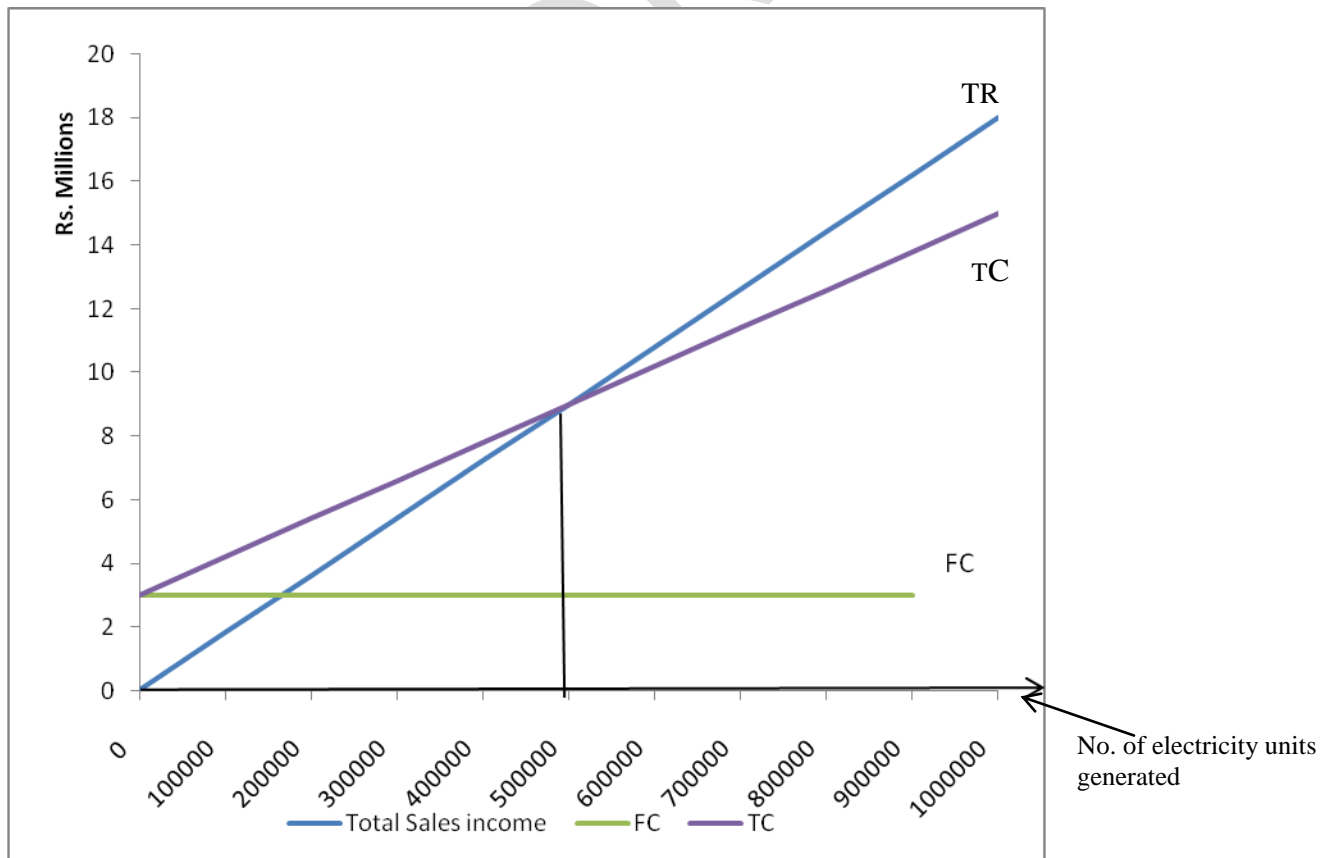
= Rs. 3,000,000

(2 marks)

(b) (i)

Number of units generated	-	100,000	200,000	300,000	400,000	500,000	600,000	700,000	800,000	900,000	1,000,000
Number of units sold	-	90,000	180,000	270,000	360,000	450,000	540,000	630,000	720,000	810,000	900,000
Total Sales income	-	1,800,000	3,600,000	5,400,000	7,200,000	9,000,000	10,800,000	12,600,000	14,400,000	16,200,000	18,000,000
Variable cost	-	1,200,000	2,400,000	3,600,000	4,800,000	6,000,000	7,200,000	8,400,000	9,600,000	10,800,000	12,000,000
FC	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
TC	3,000,000	4,200,000	5,400,000	6,600,000	7,800,000	9,000,000	10,200,000	11,400,000	12,600,000	13,800,000	15,000,000

(2 marks)



(ii) Using graph or mathematically \longrightarrow B.E units of electrical to be produced
 $= 500,000$

(3 marks)

Alternate Answer

Let No. of electricity units produced is x

\therefore Sales revenue = $0.9 \times \text{Rs. } 20\% = 18x$

Variable cost = $12x$

\therefore Contribution = $18x - 12x = 6x$

Breakeven output = $\frac{3,000,000}{6x}$

$x = 500,000$

(iii) Net profit = $20 \times 900,000 - (12 \times 1,000,000) - 3,000,000$

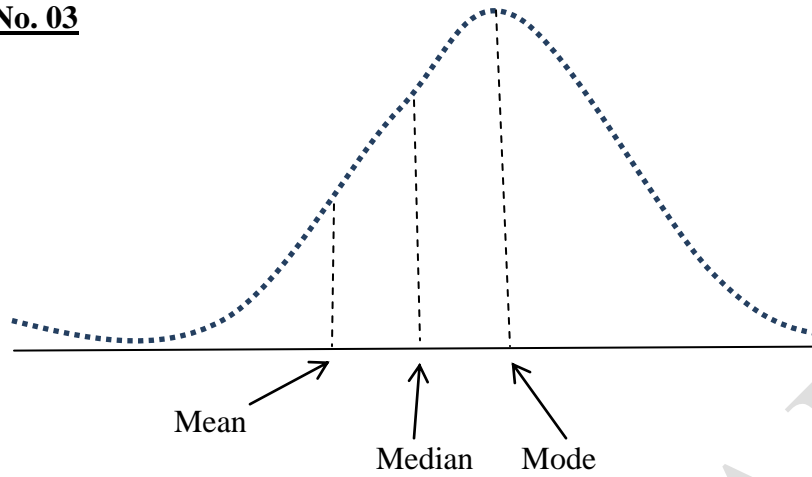
= $\text{Rs. } 3,000,000$

(2 marks)

(Total 12 marks)

Answer No. 03

(a)



Mean < Median < Mode

(2 marks)

(b)

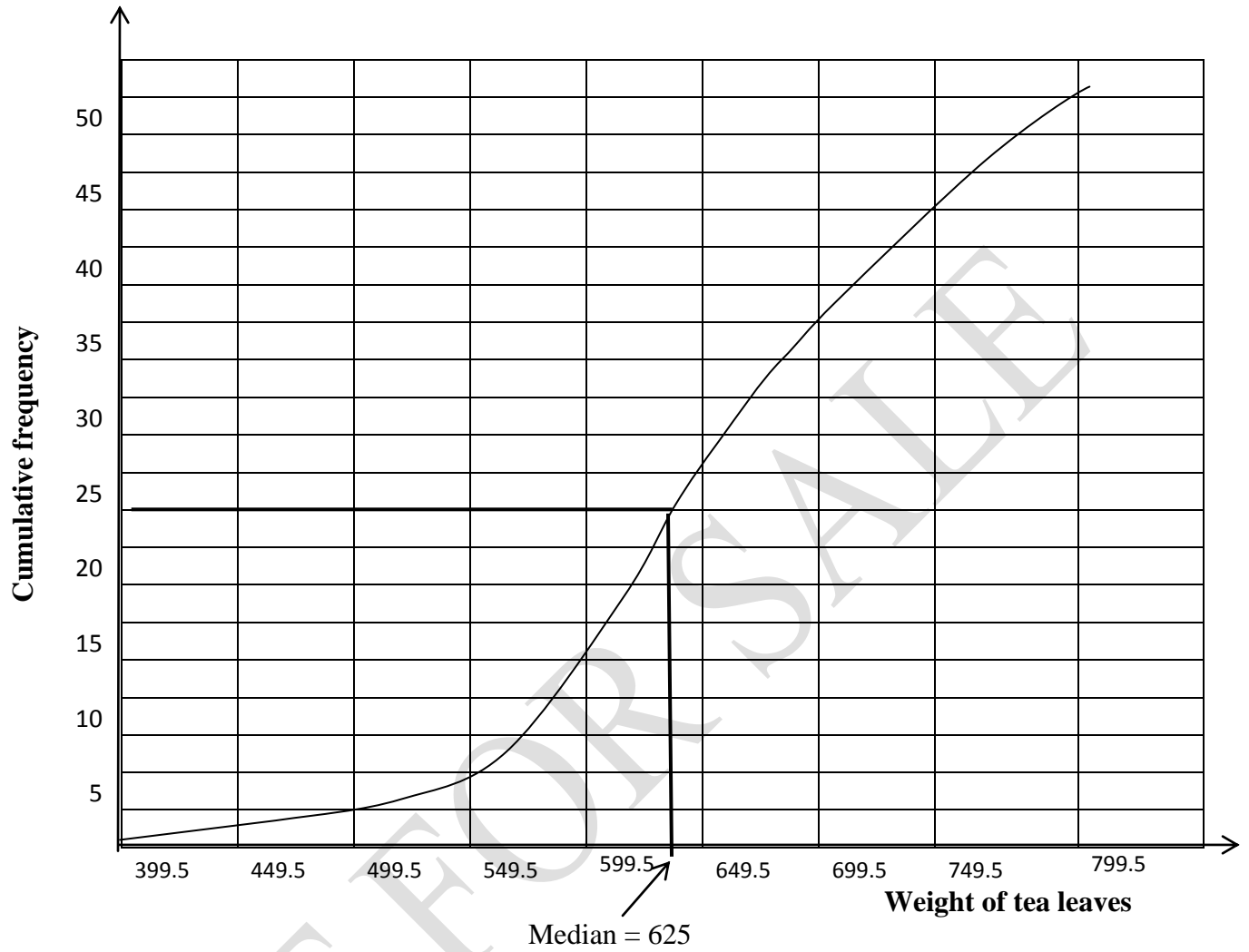
522	552	645	652	598	627	557	533	629	581
713	760	655	648	772	655	615	727	689	635
565	616	719	448	608	769	589	621	751	569
605	735	637	742	789	683	641	662	476	642
576	509	570	674	550	722	592	611	678	548

(i)

400-449	1
450-499	1
500-549	4
550-599	11
600-649	14
650-699	8
700-749	6
750-799	5
	50

Cumulative frequency Distribution (less)	Cumulative Frequency
Less than 399.5	0
Less than 449.5	1
Less than 499.5	2
Less than 549.5	6
Less than 599.5	17
Less than 649.5	31
Less than 699.5	39
Less than 749.5	45
Less than 799.5	50

(ii)



(5 marks)

(iii) Negatively skewed distribution (2 marks)

(Total 12 marks)

Answer No. 04

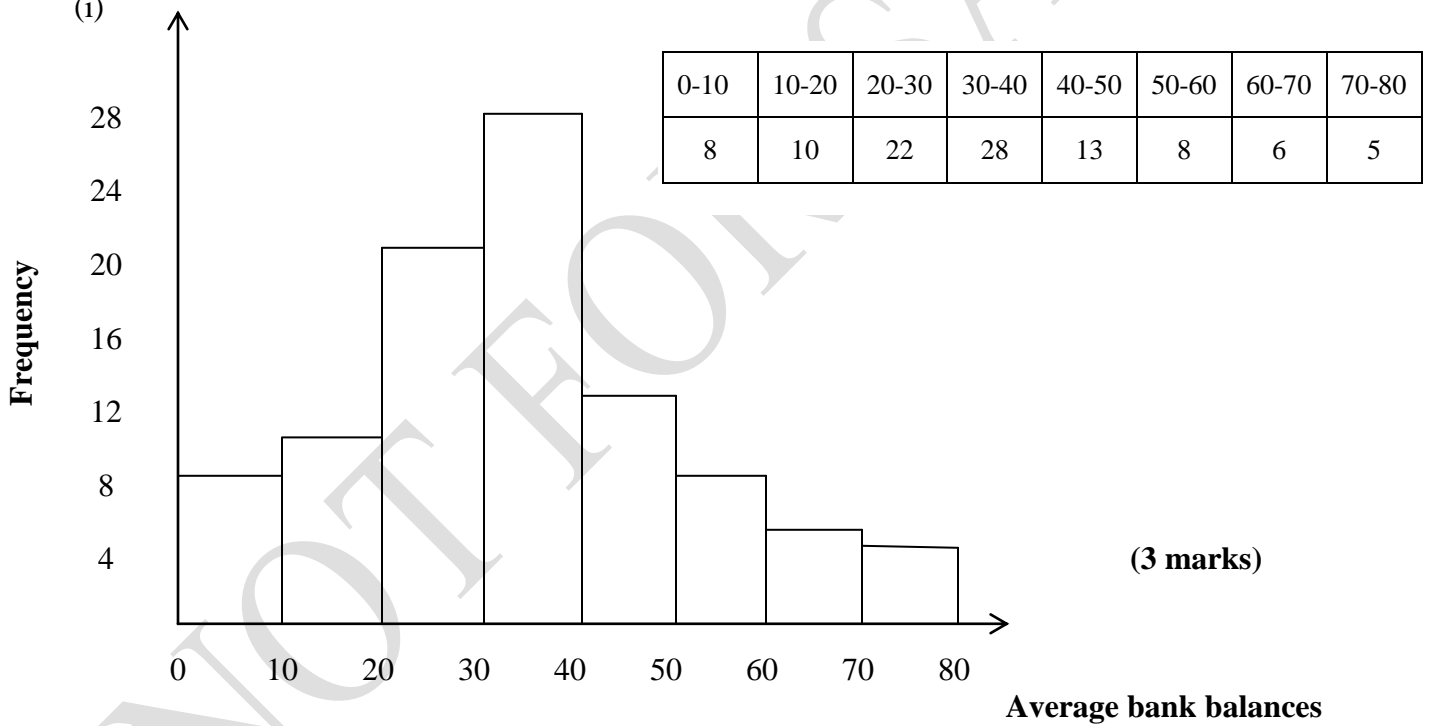
- (a) - Range
- Quartile Deviation
- Mean Deviation
- Variance and standard deviation

(2 marks)

(b)

	X	f	fx	x ²	fx ²	A=35 d=x-A	fd	d ²	fd ²	u = x - $\frac{A}{C}$	fu	fu ²
0 ≤ x < 10	5	8	40	25	200	-30	-240	900	7200	-3	-24	-72
10 ≤ x < 20	15	10	150	225	2250	-20	-200	400	4000	-2	-20	-40
20 ≤ x < 30	25	22	550	625	13750	-10	-220	100	2200	-1	-22	-22
30 ≤ x < 40	35	28	980	1225	34300	0	0	0	0	0	0	0
40 ≤ x < 50	45	13	585	2025	26325	10	130	100	1300	1	13	13
50 ≤ x < 60	55	8	440	3025	24200	20	160	400	3200	2	16	32
60 ≤ x < 70	65	6	390	4225	25350	30	180	900	5400	3	18	54
70 ≤ x < 80	75	5	375	5625	28125	40	200	1600	8000	4	20	80
	320	100	3510	17000	154500	40	10	4400	31300	4	1	313

(i)



(ii) Mean = $\frac{\sum fx}{\sum f}$

= $\frac{3510}{100}$

= 35.1

(8)

Standard Deviation

Method (1)

$$\begin{aligned} \text{(iii)SD} &= \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2} \\ &= \sqrt{\frac{31,300}{100} - \left(\frac{10^2}{100}\right)} \\ &= 17.69 \end{aligned}$$

Method (3)

$$\begin{aligned} &= \sqrt{\frac{\sum fu^2}{\sum f} - \left(\frac{\sum fu}{\sum f}\right)^2} \\ &= 10 \sqrt{\frac{313}{100} - \left(\frac{1}{100}\right)^2} \\ &= 17.69 \end{aligned}$$

Method (2)

$$\begin{aligned} &= \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} \\ &= \sqrt{\frac{154,500}{100} - 35.1^2} \\ &= 17.69 \end{aligned}$$

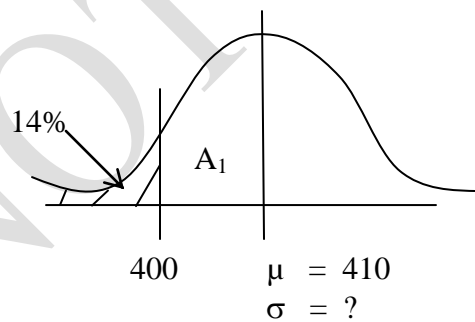
(2 marks)

(i) % customers does not maintain the minimum balance = $\frac{18}{100} = 18\%$

(2 marks)

Answer No. 05

(a) (i) Mean $\mu = \frac{4,100 \times 1,000}{10,000} = 410$ ml.



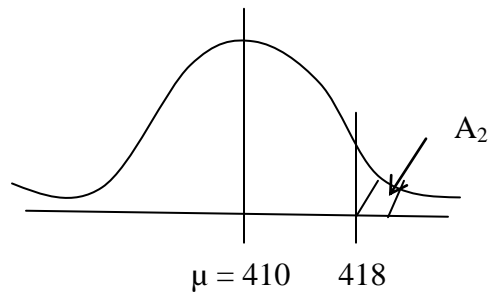
Area $A_1 = 0.36$
 $Z_1 = -1.08$

$$Z_1 = \frac{400 - 410}{\sigma} = -1.08$$

$$\sigma = 9.26$$

(3 marks)

(ii)



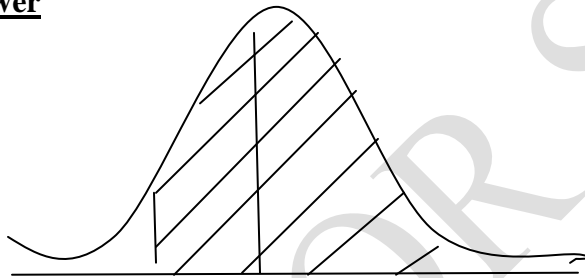
$$Z = \frac{418 - 410}{9.26} = 0.864$$

$$\begin{aligned} \text{Area } A_2 &= 0.5 - 0.3051 \\ &= 0.1949 \end{aligned}$$

(3 marks)

19.5% of the bottles in the batch will be over filled

Alternate Answer



$$Z = \frac{x - \mu}{\sigma}$$

$$Z = \frac{410 - 400}{9.26}$$

$$= 1.0799$$

$$\text{Area} = 0.3599$$

Area = 85.99% will be overfilled

(b) (i) When n becomes very large & P becomes very small, the binomial distribution approaches the Poisson distribution.

Poisson approximation is usually suitable when $n \geq 50$ and $np < 5$

(1 mark)

$$(ii) \quad p = 3\% = 0.03$$

$$q = 0.97$$

$$n = 100$$

Using binomial distribution

$$P_{(5)} = {}^{100}C_5 P^5 q^{95}$$

$$= \frac{100!}{5! 95!} \times 0.03^5 \times 0.97^{95}$$

$$= 0.101$$

Using Poisson distribution

$$\begin{aligned}
 P_{(5)} &= \frac{e^{-\lambda} \lambda^x}{x!} \\
 &= \frac{e^{-3} 3^5}{5!} & \lambda &= 100 \times 0.03 \\
 & & &= 3 \\
 &= 0.101
 \end{aligned}$$

(3 marks)

- (c) On one page we expect 1.5 misprints.
So two pages we expect 3 misprints

Let Y be the random variable of two misprints on two pages.

$$\begin{aligned}
 Y \sim P_0(3) \quad \text{so} \quad P(y=0) &= e^{-3} \\
 &= .0497
 \end{aligned}$$

$$\begin{aligned}
 \therefore P(\text{Page 427, and 428 contain non misprints}) \\
 &= .050
 \end{aligned}$$

(2 marks)

(Total 12 marks)

Answer No. 06

(a)	“X” CFL		“Q” CFL			
	n_1	=	120	n_2	=	150
	\bar{x}_1	=	721	x_2	=	730
	S_2	=	23	S_2	=	46

Population = μ_1

Population = μ_2

Standard error of the difference between mean

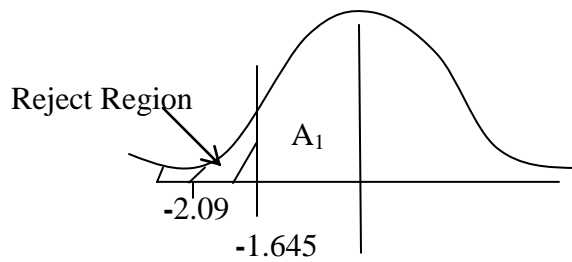
$$\begin{aligned}
 \sigma_{\bar{x}_1 - \bar{x}_2} &= \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}} \\
 &= \sqrt{\frac{23^2}{120} + \frac{46^2}{150}} \\
 &= 4.30
 \end{aligned}$$

(4 marks)

- (b) Null hypothesis $H_0 : \mu_1 = \mu_2 : \mu_1 = \mu_2 = 0$
 \therefore Alternative hypothesis $H_1 : \mu_1 < \mu_2 : \mu_1 - \mu_2 < 0$

$$\begin{aligned}
 \text{The statistic } Z &= \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \\
 &= \frac{-9}{4.3} \\
 &= -2.09
 \end{aligned}$$

(6 marks)



$$Z_1 = -2.09 < Z_{\alpha} \text{ at } 0.01 \text{ level of significance}$$

$\therefore H_0$ is rejected

“O” CFL lifespan is better than “X” CFL

$$\begin{aligned}
 \text{(c) } \beta &= 0.15 \\
 \text{Power of test} &= 1 - \beta = 0.85
 \end{aligned}$$

i.e. it has a probability of 85% that a falls hypothesis is correctly rejected.

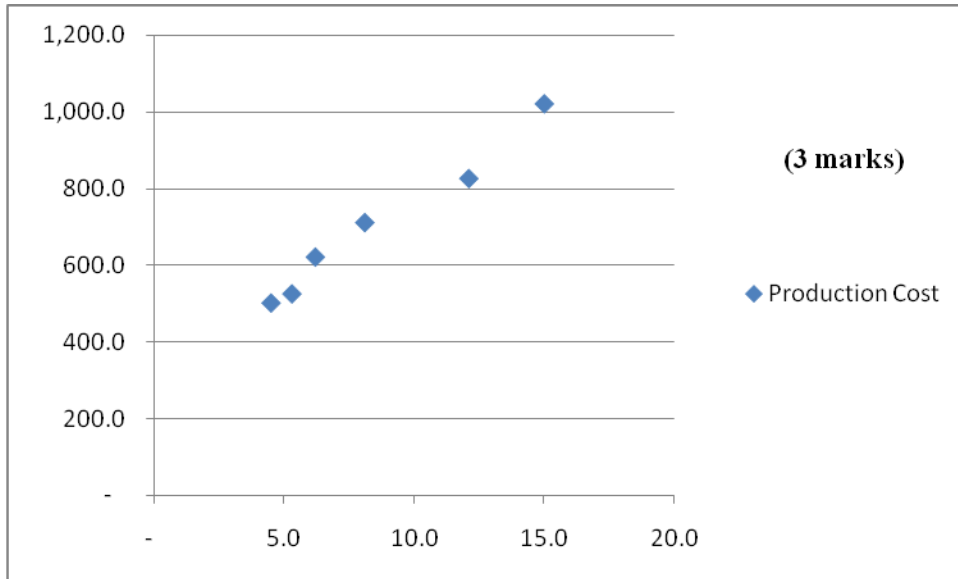
(2 marks)

(Total 12 marks)

Answer No. 07

(a) When an increase in one variable causes a decrease in the other variable, then we say that there is a negative correlation between the two variables. (2 marks)

(b) (i)



(ii)

Volume	Production Cost	xy	x ²	Y ²
6.2	620.0	3,844.0	38.4	384,400.0
8.1	710.0	5,751.0	65.6	504,100.0
12.1	825.0	9,982.5	146.4	680,625.0
4.5	500.0	2,250.0	20.3	250,000.0
5.3	524.0	2,777.2	28.1	274,576.0
15.0	1,020.0	15,300.0	225.0	1,040,400.0
51.2	4,199.0	39,904.7	523.8	3,134,101.0

Let the regression equation of production cost CVI on production line (x) be

$$y = a + bx$$

Using least square method

$$\begin{aligned} \sum y &= na + b\sum x \\ \sum xy &= a\sum x + b\sum x^2 \\ 4199 &= 6a + 51.26b \quad \text{--- (1)} \\ 39,904.7 &= 512a + 523.86b \quad \text{--- (2)} \end{aligned}$$

Solving (1) & (2)

$$\begin{aligned} a &= 299.82 \\ b &= 46.87 \end{aligned}$$

∴ Regression equation is

$$y = 299.82 + 46.87x$$

(3 marks)

(iii) $r = \frac{n\sum xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$

$$= \frac{6 \times 39905 - 51 \times 4199}{\sqrt{(6 \times 524 - (51)^2)(6 \times 3134101 - 4199^2)}}$$

$$= 0.988$$

Strong positive correlation

(4 marks)

(Total 12 marks)

Answer No. 08

(a)

4Q Moving Total		4 Quarter Centered Moving Average(T)	Percentage of actual to moving Average
377			
404	781	97.625	77.85
432	836	104.5	86.12
452	884	110.5	114.03
470	922	115.25	121.48
514	984	123	78.05
557	1071	133.875	80.67
611	1168	146	116.44
662	1273	159.125	115.00
708	1370	171.25	87.59
760	1468	183.5	86.65
800	1560	195	110.77
849	1649	206.125	114.01

	Q1	Q2	Q3	Q4	
			77.85	86.12	
	114.03	121.48	78.05	80.67	
	116.44	115.00	87.59	86.65	
	110.77	114.01			
Total	341.23	350.49	243.49	253.45	
Average	113.74	116.83	81.16	84.48	396.22
Adj	1.01	1.01	1.01		3.78
Seasonal Index	114.88	117.99	81.97	85.32	400.00

(6 marks)

(b)

Category	2010		2015		p ₀ q ₀	p _n q ₀	p ₀ q _n	p _n q _n
	Hourly rate (Rs)	Number of workers	Hourly rate (Rs)	Number of workers				
Unskilled	20	30	30	36	600	900	720	1080
Skilled	55	34	62	40	1870	2108	2200	2480
					2470	3008	2920	3560

For the year 2015

(i) Laspeyre's wage index = $\frac{\sum p_n q_0}{\sum p_0 q_0} \times 100$
= $\frac{3008}{2470} \times 100$
= 121.78

Paache's wage index = $\frac{\sum p_n q_n}{\sum p_0 q_0} \times 100$
= $\frac{3560}{2920} \times 100$
= 121.91

(4 marks)

(ii) Laspeyre's wage index (2005 – 100) = $\frac{110.5}{100} \times 121.78$
= 134.56

Paache's wage index (2005 – 100) = $\frac{111.2}{100} \times 121.91$
= 135.56

(2 marks)
(Total 12 marks)

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